Washington State
Department of Transportation

Cross-Cascades Corridor Analysis Project

Summary Report

2001

Cross-Cascasdes Corridor Analysis Project
Summary Report
Preface

The Cross-Cascades Corridor model provides a unique tool for forecasting transportation demand and understanding how our transportation systems and the economy interact. Begun as a modeling effort of the Seattle to Spokane corridor, the project has become the basis for a new approach to corridor and statewide modeling across the state. This report framework documents the effort and outlines key considerations for future model development. There are three separate documents contained in this framework that summarize and describe the modeling effort developed as part of the Cross-Cascades Corridor Analysis Project.

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These documents and supporting material require the use of Adobe Acrobat software to read and access other files via the navigation bar located on each page, in either the left or right hand side margin.

Each of these reports is explained in greater detail below. You can navigate inside the Summary Report, Model Documentation, or User Guide using the page up and down arrows. You can also enter another document by clicking on the document name at the bottom of the navigation bar. If you would like to exit the document framework altogether or return to the cover page, use the report cover icon at the bottom of the page.

Summary Report
The Summary Report provides an overview of the purpose of the project and a general description of the Cross-Cascades Corridor. The report also serves as an introduction to the model, it's structure, how it represents the corridor, the model components, how it was tested, and a demonstration of how the model estimates the effects of different events or policy decision scenarios on the corridor. Suggestions for future modeling efforts are also offered in this section.

The Summary Report has also been produced in a print-friendly format. Material contained in the printed report is the same as that shown here. To receive copies of the printed version of the document, visit the project web site at http://www.wsdot.wa.gov/ppsc/cascadesx/Cross%20Cascades%20Corridor%20Analysis%20Web/index.htm, or contact WSDOT's Transportation Planning Office by mail at Transportation Building, PO Box 47370, Olympia, WA 98504-7370, or by telephone at (360) 705-7962.

Model Documentation
The Model Documentation report provides greater deal about the inner-workings and inputs to each of the Cross-Cascades Corridor model's components - the Land Use Model, Transport Model, and Interface Model. Calibration or testing methods used during the model development effort, and the scenarios used to demonstrate the model's potential, are also described in greater detail. In some cases, topics covered in the Model Documentation report are supported with another, more detailed page that is often accompanied by an explanatory spreadsheet or example of model output. A site map for this document is available in the navigation bar on each page.

User Guide
The User Guide is designed to support the user when installing and running the MEPLAN model. This report covers the model's basic structure and the critical files that were used in its development. This document also discusses the ArcView interface and the model development project references.

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WSDOT
Travel Demand Forecasting
Cross-Cascades Corridor Analysis

Washington State Department of Transportation

Cross-Cascades Corridor Analysis Project

WSDOT - Transportation Planning Office

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Purpose & Background

The intent of the Cross-Cascades Corridor Analysis Project has been to forecast and analyze travel growth and operations in the east-west highway (I-90 and SR-2), railroad (Burlington Northern Santa Fe Railroad Stampede and Stevens Pass routes) and airway corridors between Seattle and Spokane. The project takes the first step in providing a forecast tool and planning process that can stretch across regions and fill the gaps between urban areas.

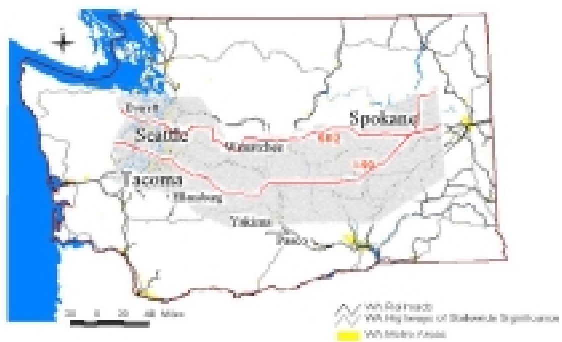

Exhibit 1: Cross-Cascades Corridor Analysis Study Area

The forecasting model developed for the project provides a unique tool to forecast transportation demands and understand how transportation and the economy interact. What began as a modeling effort in the Seattle to Spokane corridor has become the basis for a new approach to corridor and statewide modeling across the state.

The developed forecasting model recognizes that where we live affects the way we travel and where business and industry locate affects their transportation needs. Transportation, in turn, affects the investment and location decisions of businesses and individuals. Until recently the tools for analyzing these interrelationships were not available to Washington decision makers in the Legislature, the Washington State Department of Transportation (WSDOT) or local governments.

In January 2001, the WSDOT met with representatives of Metropolitan Planning Organizations (MPOs) across the state to decide how best to study the Cross-Cascades Corridor. After a daylong technical workshop WSDOT elected to develop a new plan-

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ning and forecasting model that would integrate economic, land use and transportation decisions, include all modes of transportation and produce interregional forecasts across the full length of the Cross-Cascades Corridor.

The modeling approach selected is known as a "Spatial Input-Output Model" because it considers not only the level of transportation and economic activity, but also its interaction and its spatial distribution across the state.

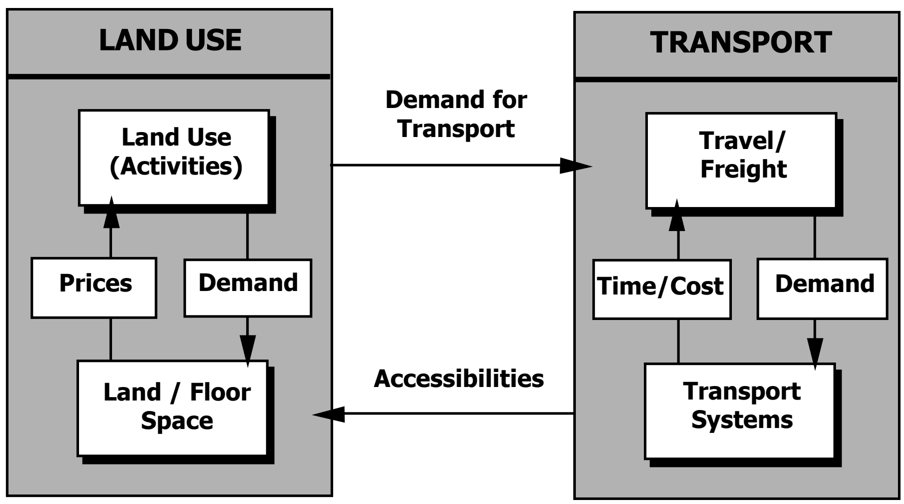

Exhibit 2: The Cross-Cascades Corridor spatial input-ouput approach combines the disciplines of land use analysis, economic analysis and transportation planning processes.

Purpose & Background

Purpose & Background of the Analysis

The objective of the Cross-Cascades Corridor Analysis was to examine inter-regional passenger and freight travel between Seattle and Spokane (in the context of the Washington Transportation Plan outcomes and performance measures) and to construct a forecasting tool that could be used in future corridor studies.

In selecting the spatial input-output model for analysis and forecasting WSDOT had several objectives:

- Produce interregional forecasts and analyses;
- Integrate output from other models;
- Be transferable and expandable to other corridors;
- Provide 6 and 20-year forecasts;
- Consider alternative modes of travel; and
- Be visually and user friendly.

The result is not a corridor plan, but rather a demonstration of the potential of a new tool for forecasting travel, evaluating transportation policies and making investment decisions. The model will be used to test multiple policy scenarios to determine how corridor transportation system changes may affect mode choice, route choice, and travel time performance. This analysis not only provides a tool for estimating demands and analyzing issues within the Cross-Cascades Corridor but also forms the basis for a statewide travel demand model.

The Cross-Cascades Corridor Analysis Project also developed a means of interfacing with urban traffic and planning models used in metropolitan areas. A benefit of the Cross-Cascades Corridor model for MPO planning will be to provide a greater degree of accuracy in the estimation of "external" trips that pass through the metropolitan areas along the corridor. The model's ability to complete detailed analysis of statewide freight activity would also augment regional modeling.

This project is one of – and distinct from – several significant on-going WSDOT technical

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analysis efforts. The others are: (1) Travel Delay Methodology, an analysis of the State's congestion relief performance measures and (2) Multi-modal Investment Choice Analysis, a multi-modal programming prioritization tool. When fully developed it will provide valuable input to these more detailed models, in terms of travel demand, traffic data and economic impacts.

Model Development Review Process

The model development effort – as depicted in the Exhibit 3 – was initiated in January 2001 at a technical workshop of WSDOT and MPO modelers in both the Cross-Cascades and I-5 corridors. A series of approaches to building the interregional model was discussed and evaluated at that workshop. The spatial input-output approach was selected, using the MEPLAN software package. At the February workshop, the consultant team's work plan was reviewed.

A third technical workshop was held in March to review the progress in model development and discuss the approach, data sources, and assumptions used for model specification, zones, and networks. In addition, ideas for the next generation of the model development

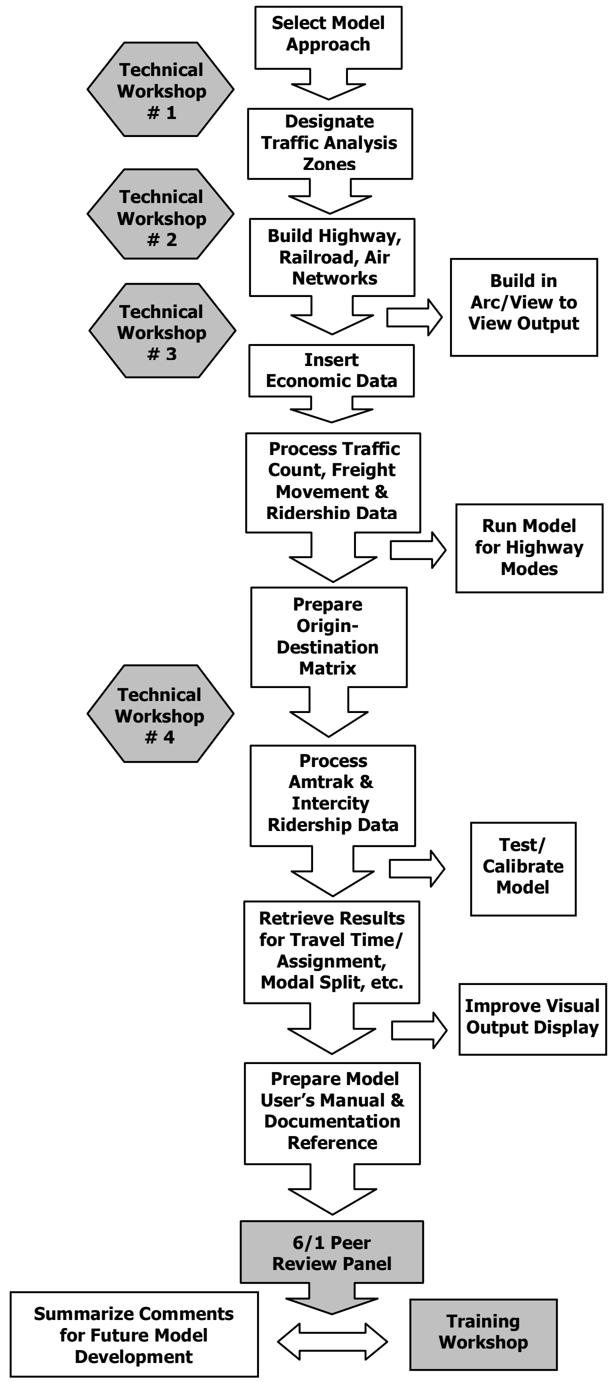

Exhibit 3: Cross-Cascades Corridor Model Development Review Process

process were collected. The purpose of the fourth workshop, held in May, was to review the operating model.

In June, a Peer Review Panel provided an independent critical assessment of the approach, methodology, data and assumptions in the development of the Cross-Cascades Corridor Analysis project's forecasting model. Peer Review Panel members were asked to evaluate the model structure, capabilities, and data needs; to assess proposed outputs, future scenarios, and overall usage; and to provide guidance for priorities for next steps in model development.

Overview of Spatial Input-Output Approach

The modeling approach selected is known generically as a spatial input-output model. It distributes household and economic activity across zones, uses links and nodes of a transportation network to connect the zones and model the transportation system before calculating transportation flows on the network. The location of households and economic activities can be thought of as the land use component of the model.

The model uses an input-output (I-O) structure of the economy to simulate economic transactions that generate transportation activity. A spatial input/output model identifies economic relationships between origins and destinations. For future years, the spatial allocation of economic activity, and thus trip flows, is influenced by the attributes of the transport network in previous years. In other words, the model is dynamic both with respect to land use and transportation (see Exhibit 4).

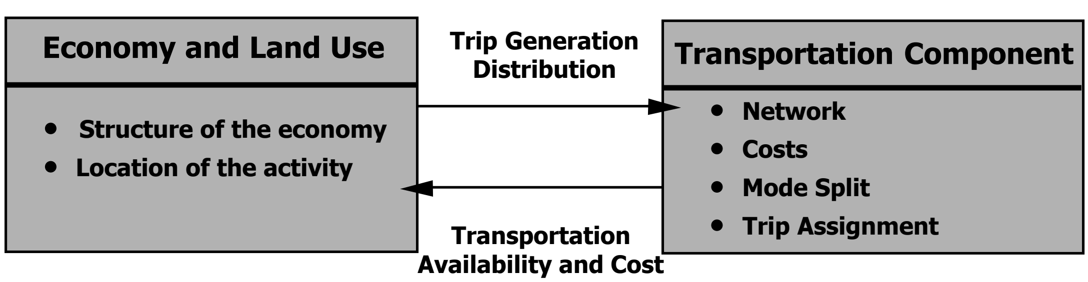

Exhibit 4: Spatial Input-Output Structure

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Model Development Process

Together, the land use and economic components, and the location of the transportation network affect transportation flows. Transportation cost, including the cost of congestion created by increasing travel demands, in turn influence the location of households and businesses.

The model is driven by exogenous economic activity generated by exports and non-wage based household income. It then uses an iterative process to forecast the study area economy and transportation demands. By making alternative assumptions about economic growth, the transportation network or travel demands, the model can evaluate the economic/land use and transport impact of various policy choices.

This basic methodology allows the model to produce forecasts of:

- Traffic volumes;
- Mode split;
- Population (households); and
- Employment.

Within the time frame for model development, the Cross-Cascades Corridor model's traffic outputs were calculated for average weekday traffic with limited congestion impacts. Additional refinement will permit the model to produce more detailed congestion metrics as well as the associated land use/economic and traveler's response to congestion.

The Model Development Process

The development of a transportation model of this complexity requires several phases (See Exhibit 5). Model construction involves specifying the initial model parameters and constraints and obtaining and loading the required data and special functions (e.g., mode split, passenger fare cost functions).

Calibration and testing of the model is the next step. Calibration and testing involves comparing the initial model results to a set of data that is considered to be of high quality (e.g.,

Model Development Process

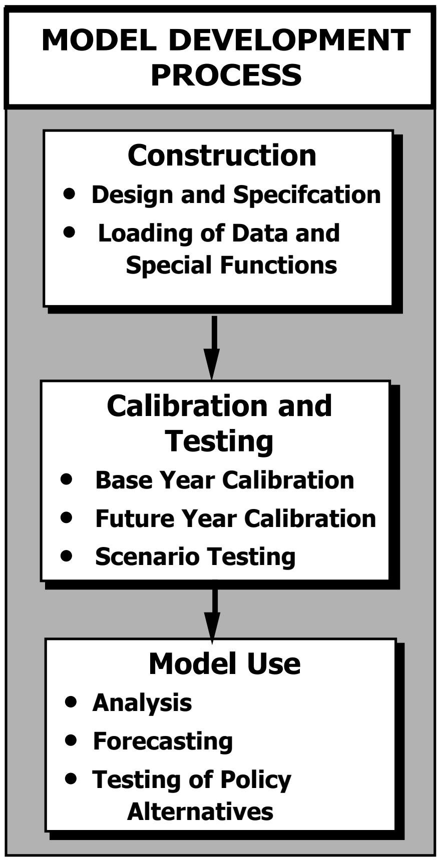

Exhibit 5: Cross-Cascades Corridor Model Development Process

traffic volumes from permanent traffic recorder machines) in order to adjust equations, parameter values, and model structure, to the unique situation for which the model is being used. In the case of the Cross-Cascades Corridor model, this involved first testing and calibrating the base year, then future years, and finally running alternative scenarios to assure the sensitivity of the model to various inputs is appropriately reflected. Calibration and testing also determines the level of accuracy of the model for future reference as it is used in planning and decision-making.

When the model is calibrated and tested it can be used to analyze present and future conditions, to forecast and to test policy alternatives.

Development Schedule

Normally a model of this complexity would be in development for as long as three years. In this case, however, WSDOT had only 16 weeks. To meet this ambitious goal, three adjustments to the typical process were made to demonstrate the value of the model and prepare for its use in other corridor or statewide plans:

1. The key land use component, land or building area of each industry and household type was omitted from this version of the model. Collection of the required data was a major time factor in similar models developed elsewhere. In addition to saving time, developing the model without those factors will allow a test of how important they are for statewide plans. The land use component (or a surrogate) can be added in future versions of the model.

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2. Development was limited to model construction with minimal calibration and testing. Continuation of the calibration and testing process will be a starting point for future model development.

3. Test scenarios were chosen to demonstrate potential uses of the model when complete, even though the results will not be validated by a fully developed model at this time.

Within the available time the model was taken through the construction phase while the model structure and inputs received significant review by modeling professionals.

Corridor Description

As shown in Exhibit 6, the Cross-Cascades Corridor model covers the area from Seattle to Spokane and is primarily concerned with travel on State Route 2 (SR-2) and Interstate 90 (I-90). Analysis included Burlington Northern Santa-Fe (BNSF) rail line facilities and east/west air travel routes to better understand the role they play in creating or relieving highway congestion.

Information for the state as a whole and several zones outside the state was also used to better represent external influences on activity inside the corridor.

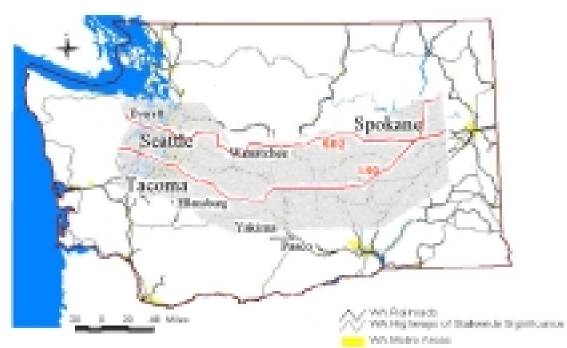

Exhibit 6: Cross-Cascades Corridor

MEPLAN

The Cross-Cascades Corridor model was constructed using the MEPLAN software package[1]. The MEPLAN software package is used in analysis and evaluation of land use and transportation conditions that occur under different public policies, economic scenarios and changes in transportation system infrastructure. The technical foundation for MEPLAN is the relationship between transportation services as derived from the economic interactions of activities such as industry raw materials and products, labor and wages, and other components of the economy.

The package is in use throughout the world by cities, counties, regions, and national governments. In addition to Washington State, Oregon and Ohio are using MEPLAN in development of their spatial input-output travel demand forecast models.

Economy and Land Use

The Cross Cascades Corridor model describes the economy and land use of the corridor and surrounding area in terms of ten industry groups and four household income groups distributed over 61 zones. (Note: all base year data was for 1998.)

The ten industry groups were based on standard industry groupings and included:

- Agriculture, forestry and fishing;
- Mining;
- Construction;
- Manufacturing;
- Transportation and public utilities;
- Wholesale trade;
- Retail trade;
- Finance, insurance and real estate;
- Services; and
- Government.

Household income groups were based roughly on quartiles and fell into the following ranges (based on 1990 U.S. Census categories):

- $0 - $17,499 (26 percent of 1990 Washington State households)
- $17,500 - $29,999 (22 percent)
- $30,000 - $49,999 (28 percent)
- Greater than $50,000 (24 percent).

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Industry and employment were distributed over 61 zones including:

- 25 sub-county zones within the corridor
  - 24 in Washington and 1 in Idaho
- 30 other county-level zones in Washington
- 6 external zones, including
  - Three in U.S.
  - Two in Canada
  - One overseas zone

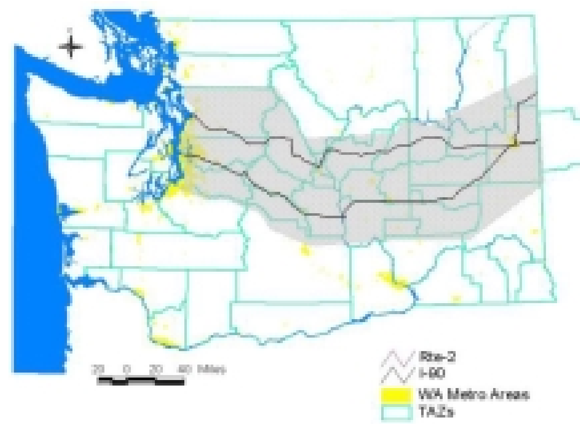

Exhibit 7: Cross-Cascades Corridor Model Transportation Analysis Zone

Within the corridor, counties were often subdivided along census division lines. Other Washington zones were kept at the county level. The zones used in the Cross-Cascades Corridor model are shown in Exhibit 7.

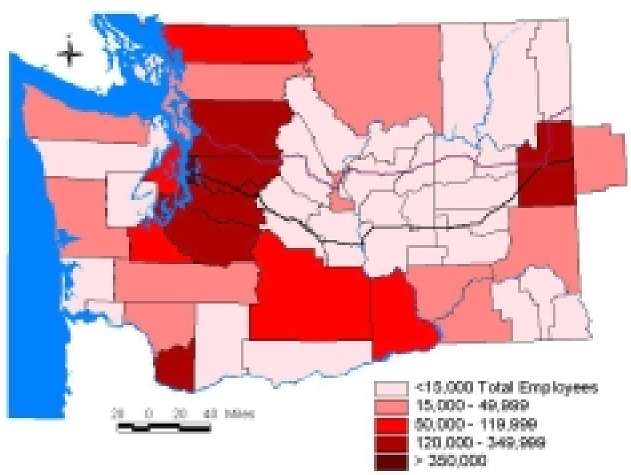

Exhibit 8: Cross-Cascades Corridor Model Employment by Zone

The distribution of employment across these zones is shown in Exhibit 8, which demonstrates the high concentration of economic activity at both ends of the corridor with sparse population and employment in between.

The structure of the economy and the exchanges between industries and labor in the form of purchase and employment can be described through an input-output (I-O) table. The Cross-Cascades Corridor model used the IMPLAN

I-O table for the Washington economy. That table (link to MEPLAN Coefficients) shows the output of each economic sector according to where the output was sold. For each industry, some output is sold to other industries, some to final consumers (households), and some is export demands.

While the economic exchange data came from the IMPLAN[2] Input-Output model, employment by place of work came from Washington State and county covered employment data, adjusted to total employment by zone. County level population and employment data for the 1998 base year were distributed to sub-county zones based on Census data.

Exogenous Demand. An important component in the Cross-Cascades Corridor model is exogenous demand[3], which includes exports and other final consumption, not purchased from wages. It is these purchases that start the economic cycle. When an industry exports a good or service, it makes additional purchases from other industries and pays wages to produce the good or service. Those purchases in turn generate more economic activity in a multiplier affect throughout the economy. In the spatial input-output model, these exchanges of economic activity generate transportation demand as goods and services are moved through production to either export or consumption, as workers travel to work or as households use some of their income for recreational, shopping or personal trips.

Exhibit 9 illustrates these economic and transportation relationships using a furniture factory, insurance service, the associated labor force and their worker's household purchases.
In general, exogenous demand was distributed to zones in proportion to:

- The zone employment levels for each industry; and
- U.S. Census "not in work" data by zone for the household groups. In the case of manufacturing, knowledge about the location of specific concentrated export businesses, in this case aircraft manufacturing, allowed for refined estimates of the location of exogenous demand.

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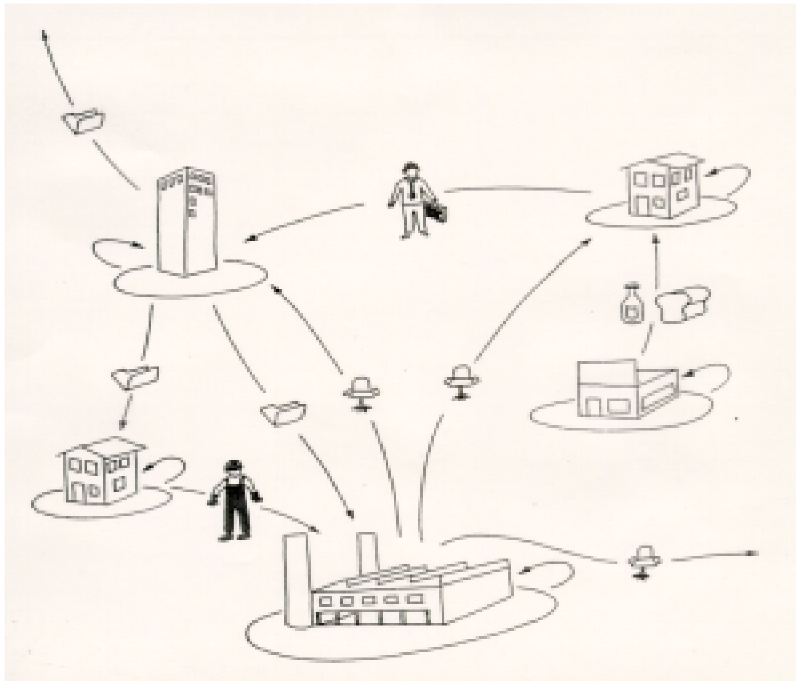

Exhibit 9: Illustration of the conceptual relationships between the economy and transportation demand, as expressed in the Cross-Cascades Corridor model.

Transportation in the Cross-Cascades Model

The Network. The transportation network in the Cross-Cascades Corridor model includes all Washington highways of statewide significance, the BNSF rail lines across Stevens Pass and Stampede Pass and the airways connecting Seattle, Wenatchee, Yakima, Moses Lake, Tri-Cities area, and Spokane. Each of these networks also includes connections to external zones.

The highway and rail networks included in the model are shown in Exhibit 10. As shown, the road network within the corridor was modeled in more detail than for the remainder of the state.

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Highways and rail lines are described in terms of links and nodes. Each link has assigned attributes of length, speed, capacity and, if applicable (as in the case of ferries), toll charges. Centroid connectors link the zones to the transport network, while special links interface between highway, rail and air networks, and public transportation service routes.

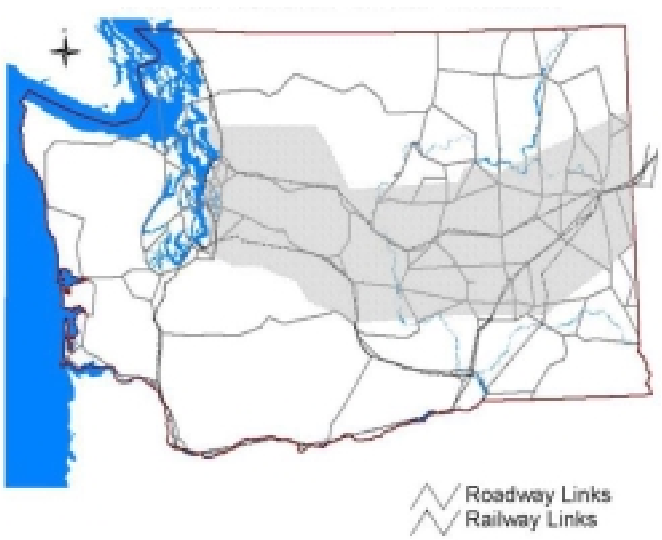

Exhibit 10: Cross-Cascades Corridor Model Road and Rail Network

Through this network each trip can be defined in terms of a series of connections. A simple highway trip may consist of travel from a centroid, along a series of links to a final destination. For example, a passenger rail trip would consist of an automobile trip to the closest rail terminal, wait time at the station, travel along the rail links to the destination terminal, and an auto trip to the final destination. In this way the appropriate flows of transportation on the network can be defined.

The data to describe the highway network came primarily from the WSDOT Travel Delay Methodology and the nodes as defined in the WSDOT's *emme2*[4] transportation network. Rail, air and public transit networks were based on national or carrier-specific data.

Transportation Volumes and Mode Split. Transportation volumes for each mode and link were determined by first calculating the desired flows that result from the economic transactions and then assigning them to modes and routes. The transport flows defined by the model include:

- Four personal passenger (commuter, shopping, visit friends & relatives, and recreation/other);
- Two business passenger (services and business promotion);
- Three freight (low, med, high value-to-weight); and
- Two external truck trip types (external-external, external-internal).

Economy/Land Use - Transportation Interface

The modes available to make these trips and shipments include:

- Air freight;
- Rail freight;
- Heavy truck freight;
- Medium truck freight;
- Air passenger;
- Amtrak (rail passenger);
- Coach (bus passenger);
- Private auto; and
- Work auto.

The transportation flows are distributed by the model to modes and routes based on factors of cost, time, and distance.

Economy/Land Use – Transportation Interface

The true value of the spatial input-output approach is the dynamic interaction between transportation and the economy. This is represented by the "Interface Model," which calculates the freight and passenger transportation "consumed" by industries and households.

Each industry group consumes a distribution of freight shipments from various value–to-weight categories. The highest value-to-weight commodities tend to travel by air, while commodities with the lowest value-to-weight ratios tend to travel by rail. Freight load factors reflect the tons carried per vehicle for each mode and each value-to-weight category.

With regard to passenger travel, the model represents households and businesses as generating six different trip purposes:

- Commuting;
- Shopping;
- Visiting friends and relatives;
- Recreation;
- Services; and
- Business promotion.

Passenger load factors reflect passengers per vehicle for each mode and trip purpose.

The model allows for more refined definitions as more information can be supplied to the model.

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Economy/Land Use - Transportation Interface

While industry and household location affect transportation, likewise transportation affects future location decisions of industry and households. The model reflects this affect by calculating transportation "disutility" for each zone and zonal pair, reflecting the time and cost of travel and goods shipments between the zones. As industries grow the model considers transportation cost in determining where expansion is likely to occur.

Changes through Time

The Cross-Cascades Corridor model is dynamic in that the activities in one time period affect subsequent time periods. Land use is initially constrained to match base year activity, while future growth is input as statewide changes to exogenous production. In the model, land use location decisions are influenced by the lagged (previous time period) transport costs. The model is set up to operate on three-year time intervals from 1998 (the base year) through 2019. This conveniently meets the WSDOT's desire to have 6 and approximate 20-year forecasts.

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Data sources utilized for model calibration are shown in Table 1. Calibration to date has focused on trip length and mode split data. Other types of data include: origin-destination trip tables; link volumes; and elasticities. Additional calibration should occur in the next phase of model development.

FOR PERSON TRIPS:
- 1995 NPTS-WA State trips and trip lengths;
- 1995 ATS-WA State trips (>100 miles) and trip lengths;
- 2000 Horizon Air WA State O-D passenger data;
- WA Airport Activity Statistics for enplaned/ deplaned passengers;
- 1999 Amtrak WA State Station on/off passenger data;
- 2000 Greyhound WA State O-D ridership(partial); and
- 2000 Northwest Trailways O-D ridership (selected destinations).

FOR FREIGHT:
- 1997 Reebie TRANSEARCH O-D flows (tons);
- 1997 US CFS WA State Internal- External (I-E)/ Interstate (I-I) tons and trip lengths;
- 1995 EWITS Internal-External Truck tons;
- 1996 WA Freight Rail Study through (E-E)/ E-I tons; and
- WA Airport Activity Statistics Cargo tonnage enplaned/deplaned.

FOR NETWORK:
- Travel Delay Methodology highway link AADT (and truck percentage);
- Synthesized highway O-D from WA traffic counts
- WA State Freight Rail Study 1996 rail ton-miles/ mile by rail segment; and
- MPO congested travel time between their external zones.

FOR FUTURE YEARS:
- Washington county-level population.

Table 1: Cross-Cascades Corridor Model Selected Data Sources

Model Scenario Testing

Even though the calibration process is not yet complete, testing has begun to determine its potential uses and to continue to calibrate the model sensitivity and improve reliability. In testing, four scenarios were created. The first reflects a base case or no-build scenario. The other three scenarios test different policy aspects and model features. They are:

- **No Build**, in which only limited planned improvements to the transportation system, and only nominal growth in exogenous demand were assumed.

- **Significant increase in transportation costs**, in which the operating costs of highway modes, including passenger cars, buses and trucks were doubled. This was chosen to test policy alternatives such as pricing or major increases in fuel prices or taxes. This scenario begins to explore questions such as: How would a significant cost increase change transportation demand? How would it change economic location decisions?

- **Major economic expansion in Eastern Washington**, in which significant new manufacturing employment was assumed along the Columbia River and in Spokane. Under this scenario, the model's ability to deal with changes in the economy was tested. Questions explored include: Would economic activity have multiplied affects in the corridor? Would it affect other areas of Washington state? What would happen to transportation demands?

- **Major improvements to the transportation system**, in which the attributes of SR-2 were changed to equal the level of service (speed and capacity) achieved on I-90. This scenario tested the impact of major transportation infrastructure investments on mode split, route choice and economic growth. This scenario explores questions such as: Would more vehicles use SR-2? Would economic growth accelerate on SR-2?

Results

The model was tested by running four hypothetical scenarios designed to demonstrate different aspects of the model capabilities and outputs. The results of the scenarios form initial validation of the predictive capability of the model. The scenario results are useful primarily for demonstration purposes until additional baseyear calibration can be completed.

In testing the model each of the scenarios was evaluated by comparing impact on:

- Employment by zone
- Households by zone
- Traffic volumes on I-90 and SR-2

An attempt was also made to evaluate mode split; however, because the calibration process was not completed, it was not possible to interpret the results of the scenarios with regard to mode split. Better specification of constraints and system characteristics along with additional calibration will improve the results in future model updates.

In evaluating the results of the scenario runs, some anomalies appeared in the base run. However, each of the scenarios resulted in different outcomes for the target measures and generally moved in the correct direction. For instance, increases in operating costs (Scenario 2) resulted in increased concentration of employment and households as well as reduced travel. Dramatic improvements to SR-2 (Scenario 4) resulted in increased economic activity in some of the zones served by that highway as well as increases in SR-2 traffic relative to I-90. Major increases in manufacturing in Eastern Washington (Scenario 3) usually resulted in total employment increases for the targeted zones that exceeded the imposed increase in manufacturing jobs. With increases in employment, households increased but travel increased only slightly. This is probably because incomplete calibration resulted in very long commutes that were shortened by the presence of new employment in the zones.

The conclusion of the scenario testing found that the model is working and responds to the proposed scenario policy questions in its predictions of future economic and travel activity. The results cannot be properly interpreted, however, until the model is fully calibrated.

Purpose & Background of the Analysis
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Model Development Process
Corridor Description
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Next Steps

During both the model development/testing and peer review processes, a number of suggestions were generated for improvement in future modeling efforts. These are presented as incremental to the basic structure of the spatial I-O approach that was overwhelmingly supported for statewide modeling during each step of the process. All of the suggestions are assumed to be possible within the MEPLAN or extended spatial I-O model structure begun under this project. Moreover, the comments are geared towards expanding the model to a statewide level, rather than a corridor-by-corridor approach. This would allow all future corridor efforts to benefit from the comprehensive view of their role within the larger statewide system, and more accurately account for the impacts of competing corridors.

The major recommendations for future model development are summarized below.

Short-term Steps:

1. **Continue Cross-Cascades Corridor Model Calibration** - To provide reliable forecasts for the corridor.
2. **Allow for Elastic Economic Relationships** – This involves allowing the technical coefficients in the input/output model to vary with prices and utility. The initial assumption in the model design was that the interrelationship between different factors was constant across the state. In calibration, it became apparent that there are important differences between areas of the state.
3. **Increase the Number of Zones** - After reviewing early model runs it appears that overall intercity trip lengths on the highway system are too long. This appears to trace back to large size of the zones used in the model. For the purposes of statewide corridor modeling, 300-400 zones should provide sufficient accuracy.
4. **Expand Model Scope** – It is recommended that the model be expanded to include all of Washington State at a consistent level of detail, and to include a higher level of detail in border regions of neighboring states and provinces. The number of external zones should also be increased. A broader model would allow the assessment some trip allocations that could not be considered in the present structure of the model.

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Next Steps

5. **Incorporate Land Use** - Introducing land area and prices in the economy/land use element of the model will permit more accurate evaluation of industry and household location possibilities, particularly near metropolitan areas. Given the statewide nature of the model, the possibility of a surrogate measure that avoids extensive new data collection should be considered.

Long-term Steps:

1. **Better Washington State Data** - The model was constructed with national data on person travel. Additional supplementary primary data collection regarding the travel of people and goods in Washington would improve the model performance and credibility. For example, more specific data on commuting trip patterns (i.e., a household O-D survey) could be used to calibrate the travel model and could help to establish the variability of some technical coefficients as described above. In addition, an Establishment Survey, which surveys selected business about their transport activity over a representative period, would be helpful in better understanding small goods movement and service trips.

In addition to these key recommendations for future development, there are also a number of more technical adjustments included in Model Documentation.

While these adjustments will provide useful improvements to future models the next step in the Cross-Cascades Corridor model will be to:

1. Complete calibration and testing while defining data collection needs;
2. Use the model to evaluate conditions in the corridor and test alternative transportation investment and policy options; and
3. Apply the model to the next corridor study, probably in the I-5 corridor.

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Conclusion

The Cross-Cascades Corridor Analysis Project accomplished three primary objectives:

- The project established a new model and model process, which will be used as the foundation for future development of a statewide model for Washington State;
- The project demonstrated the use and value of the model for analysis of policy scenarios; and
- The model provides a means for providing through trip and external trip information for use in planning processes throughout the State.

Moreover, the Cross-Cascades Corridor Analysis Project has provided a blueprint for how to complete multimodal transportation analysis over multiple regions, and how to partner with technical analysts from state, regional and metropolitan area agencies. The value of the tools and the processes developed in the Cross-Cascades Corridor Analysis Project should provide value for decision makers in answering questions about whether: transportation investments meet their objectives; whether some investments are more cost effective than others; and whether transportation investments

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References/Glossary

support economic development initiatives.

The following materials were referenced in the Cross-Cascades Corridor Anlaysis Project Summary Report:

[1] MEPLAN software package, Marcial Echenique & Partners, LTD., Cambridge, UK

[2] IMPLAN 2000, Minnesota IMPLAN Group, Stillwater, MN, 2000

[3] Defined in this project as the economic activity that results from exports, federal transfer payments, and other cash flows that originate from outside the Cross-Cascades Corridor model's 61 zones.

[4] emme/2 is an interactive graphic transportation planning package which was originally written by Michael Florian and Heinz Spiess at the Centre de recherche sur les transports (CRT) of the University of Montreal. It is distributed by INRO Consultants Inc. in Montreal (fon: (514) 369-2023, fax: (514) 369-2026). WSDOT has produced a statewide transportation network using the emme/2 software package.

Other references and acronymns used as part of the Cross-Cascades Corridor Analysis Project model documentation effort are available in the Model Documentation report.